

Feasibility Investigation for a Solar Power Generation Facility

Lakshmi Nathan

Mentor: Rob Way
NASA Johnson Space Center



Introduction and Abstract

The Energy Policy Act of 2005 states that by fiscal year 2013, at least 7.5% of the energy consumed by the government must be renewable energy. In an effort to help meet this goal, Johnson Space Center (JSC) is considering installing a solar power generation facility. The purpose of this project is to conduct a feasibility investigation for such a facility. Because Kennedy Space Center (KSC) has a solar power generation facility, the first step in this investigation is to learn about KSC's facility and obtain information on how it was constructed. After collecting this information, the following must be determined: the amount of power desired, the size of the facility, potential locations for it, and estimated construction and maintenance costs. Contacts with JSC's energy provider must also be established to determine if a partnership would be agreeable to both parties. Lastly, all of this data must be analyzed to decide whether or not JSC should construct the facility.

The results from analyzing the data collected indicate that a 200 kW facility would provide enough energy to meet 1% of JSC's energy demand. This facility would require less than 1 acre of land. In the map below, potential locations are shown in green.

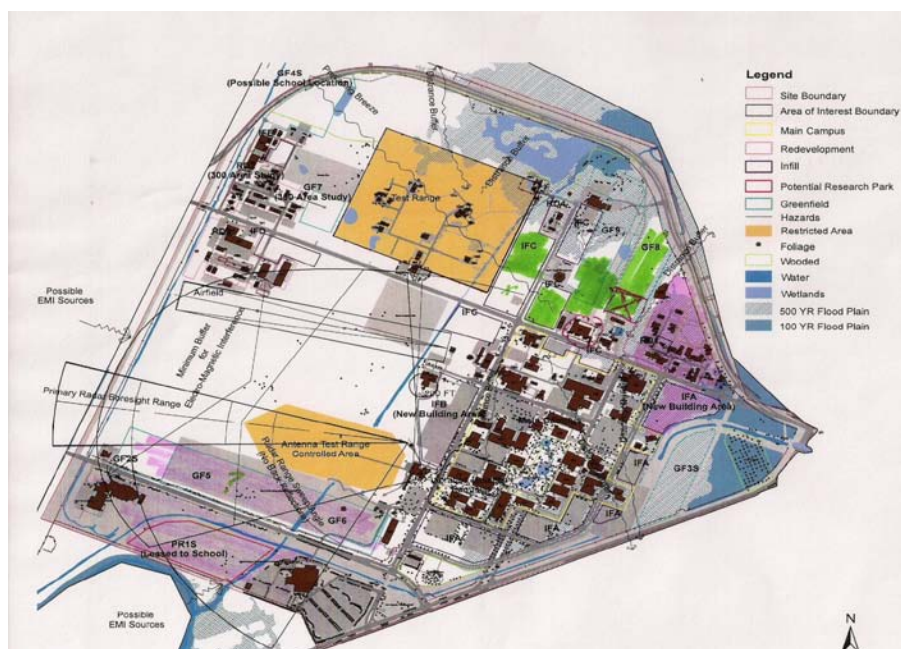


Figure 1: Green areas show potential locations for solar facility within JSC

The solar power facility is projected to cost \$2 M. So far, the information collected indicates that such a facility could be constructed. The next steps in this investigation include contacting JSC's energy provider, CenterPoint Energy, to discuss entering a partnership; developing a life cycle cost analysis to determine payback time; developing more detailed plans; and securing funding.

Goals and Purpose of the Project

At every NASA center, the Energy Manager is responsible for monitoring the center's energy use, reducing energy consumption, and promoting sustainable energy practices.

Compliance with the Energy and Policy Act of 2005 falls under the Energy Manager's jurisdiction, and the construction of a solar power generation facility will contribute to meeting the requirements of this act. The purpose of the feasibility investigation is to determine if building a solar power generation facility would be a sensible way to increase the center's renewable energy usage.

I conducted the entire study myself; first collecting and analyzing information from KSC, then from JSC, Honeywell, and Sacred Power Corporation. Information on JSC's energy consumption came from Honeywell, who is responsible for monitoring JSC's energy usage. Sacred Power is a solar power company that worked with JSC on a project to install solar panels at JSC's Child Care Center. Sacred Power did all of the calculations for the potential solar power facility size. The cost of the facility was determined based on a comparison between the proposed 200 kW facility and KSC's 945 kW facility. Possible locations for the facility were selected based on the location of JSC's substation and open land area in JSC's master plan.

From discussion with KSC's Energy Manager, I learned that KSC has an agreement with Florida Power and Light (FPL) whereby FPL is allowed to have a 10 MW solar facility on KSC property in exchange for constructing and maintaining a 945 kW facility for KSC. Power from the 10 MW facility goes to homes while power from the 945 kW facility is used by KSC.

Combined, the two facilities occupy about 65 acres. The 945 kW facility generates approximately 1% of the energy consumed by KSC. Both facilities use SunPower model 315 panels, which are more efficient than typical solar panels. Drawings of the facility show that solar power from the facility does not go to a specific building but rather is fed to KSC's grid through a substation. So far, the solar facility has saved KSC over \$125,000.

Information from Honeywell shows that, on average, JSC uses 170 million kWh in one year. To meet 1% of the average energy demand, a 200 kW facility is needed. This facility would require 0.64 acres of land and will cost about \$2 M. Potential problems with the facility include a long payback time, possible damage due to hurricanes, and CenterPoint not wanting to enter a partnership.

The data I have collected has laid the foundation for developing a more detailed proposal to construct a solar power facility. Now that information from KSC has been obtained, the Planning and Integration Office, which houses the Energy Manager, can move forward with developing plans for the facility. The facility would help JSC reach its renewable energy requirements. Like many other businesses, NASA is working towards a greener future.

Impact of the MUST Internship on My Career Goals

This internship reinforced my desire to pursue a career in engineering and led me to consider working for NASA. As I talked to NASA engineers throughout my internship, I found that the projects they work on appeal to me. While I have seen that studying science and engineering is very different from actually working in those fields, my experience has shown me that I greatly enjoy science and engineering in both forms. Before this internship, I knew I wanted to do research, but I had only considered academia and did not contemplate doing research in industry or for the government. Working with the Energy Manager allowed me to see

a variety of jobs at NASA that are not strictly aerospace-related and has piqued my interest in pursuing a career at NASA.

Working with the Planning and Integration office taught me about more than just what the business and government worlds are like. When working, I often come across questions my mentor did not have answers to. He showed me that sometimes it is better to ask the experts for help than to try to become an expert. This internship also taught me about project management. I got to see first-hand how projects of all sizes are managed. For example, my project showed me the steps involved in beginning a project, but I also sat in on planning meetings for a clean room that will house the James Webb Space Telescope as it undergoes testing. These meetings ranged from teleconferences involving multiple NASA centers and companies to meetings of five people. I presented the results of my feasibility study at a sustainability team meeting which helped me improve my presentation skills. I also gained experience with collecting information from sources scattered throughout the country.

Throughout the program, I received guidance from many mentors. During the school year, my graduate student mentor and I discussed graduate school. While completing my internship, my mentor and I discussed my university, career plans, and difficulties with my project. Other MUST scholars also gave me guidance by sharing internship experiences, giving advice and encouragement, and discussing future plans.

My time in the MUST program has met all of my expectations. My decision to pursue a career in engineering has been bolstered by my experiences at NASA and the guidance my mentors have given me. The skills and knowledge I gained during my internship at JSC have made me confident in the work place. Being a part of the NASA workforce has inspired me.